MV-22 Inputs
from Jeff Jorgenson

We have not analyzed HOPS and PPC for functional coverage.

We will generate our NATOPS Weight and Power card (called a Load Comp card in our NATOPS) via Excel outside of JTIE. I pasted a sample (out of our UIDD) on this page. JTIE does not provide an easy way of selecting points within route, and we wanted to generate this form for any route point (actually, JMPS Command).

DATE	EVENT	MODEX
PILOT	COPILOT	CREW

	DEPARTURE POINT	DESTINATION POINT
OAT/PA/DA/WINDS	°c/ / /	°c/ / /

	DEPARTURE POINT	DESTINATION POINT
BASIC WEIGHT	lbs	lbs
+ CREW	lbs	lbs
+ MISCELLANEOUS (MSN SPECIFIC KITS)	lbs	lbs
= OPERATING WEIGHT	lbs	lbs
+ FUEL	lbs	lbs
+ PAYLOAD	lbs	lbs
= MISSION WEIGHT	lbs	lbs

		DEPARTURE POINT		DESTINATION POINT	
MAST TORQUE AVAIL (N/I)	(a)	(N)	/(I)	(N)	/(I)
MAST TORQUE REQ (N)	(b)	(HOGE	/HIGE)	(HOGE	/HIGE)
MAST TORQUE REQ (I)	(c)	(HOGE	/HIGE)	(HOGE	/HIGE)
MAST TORQUE MARGIN (N)	(a-b)	(HOGE	/HIGE)	(HOGE	/HIGE)
MAST TORQUE MARGIN (I)	(a-c)	(HOGE	/HIGE)	(HOGE	/HIGE)

		DEPARTURE POINT	DESTINATION POINT
MAX HOGE WEIGHT WITH (_____)% TORQUE MARGIN (I)	(c)	lbs	lbs
MISSION WEIGHT	(d)	lbs	lbs
MAX ALLOWABLE PAYLOAD	(c-d)	lbs	lbs
MAX HOGE WEIGHT (I) zero Qm margin	(e)	lbs	lbs

MAX RANGE AIRSPEED (f)	
MAX ENDURANCE AIRSPEED (g)	
PWR-OFF STALL SPEED (FLAPS AUTO) (h)	

SINGLE ENGINE LEVEL FLIGHT
(@ MISSION WEIGHT)

MAX ALT OEI (CONV MODE) (I)	@ (aspd)	MAX ALT OEI (APLN MODE) (J)	@	(aspd)
A/S ENVELOPE (CONV MODE) (I)	KCAS to	KCAS @	ft MSL	
A/S ENVELOPE (APLN MODE) (J)	KCAS to	KCAS @	ft MSL	

We do not currently allow for the user selectable factors, with the exception of a torque margin on certain screens. For some parameters we show all cases (engine settings, for example). For drag value, we use the value from the route. We do not currently have a completely stand-alone capability. It is always connected with a route.

We have an explicit "What-If" calculator UI. By default, it gets the input parameters from the route. The user can override the parameters for what-if calculations. This data is not fed back to the route due to difficulties taking cargo weight and splitiing it into cargo items. Instead we generate a "loadout message" that reminds the user that they planned on having a particular gross weight and fuel load on a specific V-22 leg (that is, JMPS command). The user then needs to go back to the loadout tab (similar to the JMPS Vehicle configuration) to load the aircraft. These calculations can be done for the takeoff or landing condition for each JMPS command.

We also make sure and show both the inputs and outputs for all calculations, which should eliminate the need to see the "route, legs, points, commands, and transitions." By the way, you should add "state" to this list to pick up both arrival and departure information for a transition.

Attached (in the next three slides) is our loadout screen and calculator screen, again from our UIDD. Note that we have both hover and airplane characteristics to consider.

V-22 Leg Editor

Leg | Loadout | Calculator

AIRCRAFT

Operating Weight: [   ] lbs

	Performance	Loadout	
Fuel:	[ ]	[ ]	lbs
PAX:	[ ]	[ ]	lbs
INT Cargo:	[ ]	[ ]	lbs
EXT Cargo:	[ ]	[ ]	lbs
Gross Weight:	[ ]	[ ]	lbs

[Send]   [Reset]

LOADOUT MESSAGES

[   ]

[Clear]   [Clear All]

Hover/STOL | Airplane

LEG ENVIRONMENT

	Performance	Route	
Altitude:	[ ]	[ ]	ft MSL
OAT:	[ ]	[ ]	deg C

[Reset]

AEO AIRPLANE PERFORMANCE

Gross Weight/Sigma:	[ ]	lbs
(Level Flight) Est. Fuel Burn:	[ ]	lbs
Best Endurance Airspeed:	[ ]	KCAS
99% Best Range Airspeed:	[ ]	KCAS
0 deg AOB Stall Speed:	[ ]	KCAS
30 deg AOB Stall Speed:	[ ]	KCAS
45 deg AOB Stall Speed:	[ ]	KCAS
Service Ceiling:	[ ]	ft MSL
Max Rate Of Climb Airspeed:	[ ]	KCAS
Rate Of Climb:	[ ]	ft/min

EMERGENCY PERFORMANCE

OEI (60 NAC) STD Day

Max Rate Of Climb Airspeed:	[ ]	KCAS
Rate Of Climb:	[ ]	ft/min
Vmin:	[ ]	KCAS
Vmax:	[ ]	KCAS

OEI AIRPLANE (STD DAY)

99% Best Range Airspeed:	[ ]	KCAS
(All Temps) Service Ceiling:	[ ]	ft MSL
Max ROC Aspd:	[ ]	KCAS
Rate Of Climb:	[ ]	ft/min
MCP Vmin:	[ ]	KCAS
MCP Vmax:	[ ]	KCAS

Leg: [2] ▲▼   Leg Type: [Cruise]   From Rt Point: [3] [KVPS/A]   To Rt Point: [4] [.XYZ]   Status: [Not Calculated]   [Summaries ...]   [Close]   [Help]

V-22 Leg Editor

Loadout | Leg | Calculator

Top station labels (columns):
C 289 in | D 340 in | E 403 in | F 465 in | G 528 in | H 603 in

227 in | 262 in

Pilot
Jump Seat
Copilot

CC 2 4 6 8 10 12 14 16 18 20 22 24

0 lbs | 0 lbs | 500 lbs | 0 lbs | 0 lbs | 0 lbs

1 3 5 7 9 11 13 15 17 19 21 23

Airplane
382.8
377.4   394.8
Helicopter
390.2   407.6
395.6

GROSS WEIGHT lbs

LOAD PLANS
Save...
Open...
Delete...

Form F...
Load Comp...
Previous Load
Calc Route

LOAD SUMMARY

EXTERNAL LOADS

Distribution

Forward:	1000 lbs	50 %
Aft:	1000 lbs	50 %
Tandem: EXTERNAL	2000	Total Wt

Flat Plate: 20 sq ft   Airspeed Limit: 280T Knots

HOVER INFO
Wheel Height: 15 ft AGL
Surface Temperature: 15 deg C
Elevation: UNK ft MSL

Max Gross Weight
HOGE: 48025 lbs
HIGE: 51811 lbs

LOADOUT MESSAGES

Clear
Clear All

ZONES

Zone	lbs	Item Name
E	500	Palette

STATIONS

	Station	lbs	Item Name
Item 1			
Item 2			
Item 3			

FUEL

- ⦿ Amount to Transfer   0 lbs
- ○ Desired FOB
- ○ Fill to Gross Weight
- ○ Top Off Tanks

Onload Transfer Method
Pressurized

FOB at Source: lbs
FOB at Destination: lbs
Amount Transferred: lbs

LOAD ITEMS
INTERNAL (0)

PAX / PATIENTS

	PAX	Patients
Weight:	240	180 lbs
Quantity:	10	0

Leg 2   Leg Type Cruise   From Rt Point 2   To Rt Point 3   Status Not Calculated   Summaries...   Close   Help

V-22 Leg View

_ □ ×

Leg | Loadout | Calculator

Hover/STOL | Airplane

AIRCRAFT

	Performance	Loadout	
Oper. Weight:			lbs
Fuel:			lbs
PAX:			lbs
INT Cargo:			lbs
EXT Cargo:			lbs
Gross Weight:			lbs

[Send] [Reset]

LOADOUT MESSAGES

[Clear] [Clear All]

LEG SOURCE WAYPOINT

Environment

	Performance	Route	
Elevation:			ft MSL
Surface Temp:			deg C
Density Altitude:		ft MSL	
Wheel Height:		ft AGL	[Reset]

Hover Performance

Gross Weight:		lbs
Fuel:		lbs

	Normal	Interim	
Qm Available:			%
Qm Required			
HIGE (_Wh/Ht_ ft):			%
HOGE:			%
Max Gross Weight			
HIGE (_Wh/Ht_ ft):			lbs
HOGE:			lbs

Short Takeoff (0 FT, 32 C)

Speed:		KCAS
Roll:		ft
50' Obstacle Clearance:		ft

LEG DESTINATION WAYPOINT

Environment

	Performance	Route	
Elevation:			ft MSL
Surface Temp:			deg C
Density Altitude:		ft MSL	
Wheel Height:		ft AGL	[Reset]

Hover Performance

Gross Weight:		lbs
Fuel:		lbs

	Normal	Interim	
Qm Available:			%
Qm Required			
HIGE (_Wh/Ht_ ft):			%
HOGE:			%
Max Gross Weight			
HIGE (_Wh/Ht_ ft):			lbs
HOGE:			lbs

Leg: 2 | Leg Type: Cruise | From Rt Point: 3 | KVPS/A | To Rt Point: 4 | XYZ | Status: Not Calculated

[Summaries ...] [Close] [Help]

V-22 allows calculations for each JMPS command. It does not currently do calc inserted points (except when mapped to a command like Hover), nor does it do some arbitrary point choosen by the user.

See previous slide about "Write to Route" capability. This should be doable if you don't care about the details of the load configuration. (In other words, if you only care about "I lost 10,000 pounds here" instead of "I lost 15,000 pounds of the hooks and gained 5000 pounds in cargo zone D".)

Wheel height is a route attribute for legs. I would expect "hover height" for cruise legs to be the same as AGL altitude. We also always calculate both HIGE and HOGE, since hovering on a L-class ship can put one rotor in ground effect and the other one out!

We are rolling time limited events into our alerts calculator. By the way, I don't think there can be a complete solution in the FPM. If you have a 20 minute limit for hovering, the FPM could catch a 30 minute atempt to hover, but not two 15 minute back-to-back hovers. That should be in the calc engine somewhere for the route. For the what-if ability, the FPM could be relied upon.

We do not have requirements for "Optimizations", nor for an alternate point not on a route.

On this slide I have put our "Performance Summary" which I would call our "Route View". I also included our "Loadout Summary" which shows load changes throughout the route. I would consider our Calculator tab on a previous slide to the "Point View", although we would use the term "Leg". (One danger with using the term "Point View" is that you really want commands instead of points. In other words, you want the condition arriving at a point, then starting to hover, then ending the hover, then leaving the point. Four conditions for one point, assuming one hover or loiter.)

Note: We do not include calc inserted points (transitions).

We use certain fields red or yellow based upon performance criteria.

		1		2		3		4		5		6	
1 Leg #		Loiter		Cruise		Cruise		Hover		Cruise		Cruise	
2 Leg Type													
3 From Route Point (#/Fix Pt.)		1	KVPS	1	KVPS	2		3		3		4	
4 To Route Point (#/Fix Pt.)		1	KVPS	2		3		3		4		5	
5 HOVER / Short Takeoff													
6 Gross Weight (From/To)	lbs	51238	50838	50838	50085	50085	47116	47116	46942	46942	46183	46183	45637
7 Elevation (From/To)	ft MSL	85	85	85	500	500	10	10	10	10	500	500	0
8 Surface Temp. (From/To)	dec C	14	13	13	14	14	14	14	13	13	14	14	15
9 Wheel Height (From/To)	ft AGL	15	15	15	15	15	15	15	15	15	15	15	15
10 Hover (Normal)													
11 Qm Avail (From/To)	%	100	100	100	100	100	100	100	100	100	100	100	100
12 Qm Req HIGE (From/To)	%	89	89	89	89	89	89	89	89	89	89	89	89
13 Qm Req HOGE (From/To)	%	97	97	97	97	97	97	97	97	97	97	97	97
14 Qm Req (MGW=52600) HOGE (From/To)	%	118	118	118	118	118	118	118	118	118	118	118	118
15 SHORT TAKEOFF													
16 Roll Distance (From)	ft	293		263		206		NC		NC		NC	
17 Distance to 50ft Obstacle (From)	ft	991		930		813		NC		NC		NC	
18 AIRPLANE													
19 Gross Weight	lbs	47838		47438		4600		42105		39566		38603	
20 Altitude	ft MSL	50		500		1100		1100		1200		1200	
21 OAT	deg C	10		10		10		10		10		10	
22 All Engines Operative													
23 Max Range Airspeed	KCAS	233		232		232		229		227		228	
24 Service Ceiling	ft MSL	21068		21239		21563		22899		22980		23336	
25 Rate of Climb	ft/min	2469		2488		2602		3004		3005		3131	
26 One Engine Inoperative													
27 Max Range Airspeed (Std Day)	KCAS	206		200		210		207		205		206	
28 Service Ceiling	ft MSL	6618		6757		7064		8443		8527		8896	
29 Rate of Climb (Std Day)	ft/min	1036		948		1154		1467		1343		1574	

I'm not sure what the tree view is for. It might be asking for a navigation mechanism to go from a route to legs to points to commands to transitions, or something similar. I still think it would be better to display all input parameters instead of having the user wade through the route structure.

Our "Performance Summary" (route view) is generated in Excel, so the user has all of the capability (and limitations) of using that product to declutter their display.

We provide both the normal error messages from the FPM/Calc Engine, plus we add an alerting capability that continues to be displayed after the calc messages are acknowledged. We do not tie that capability in with graphical or text editor displays. I attached an image of our alert UI to this slide. Note that this is a docked control like the JMPS Explorer.
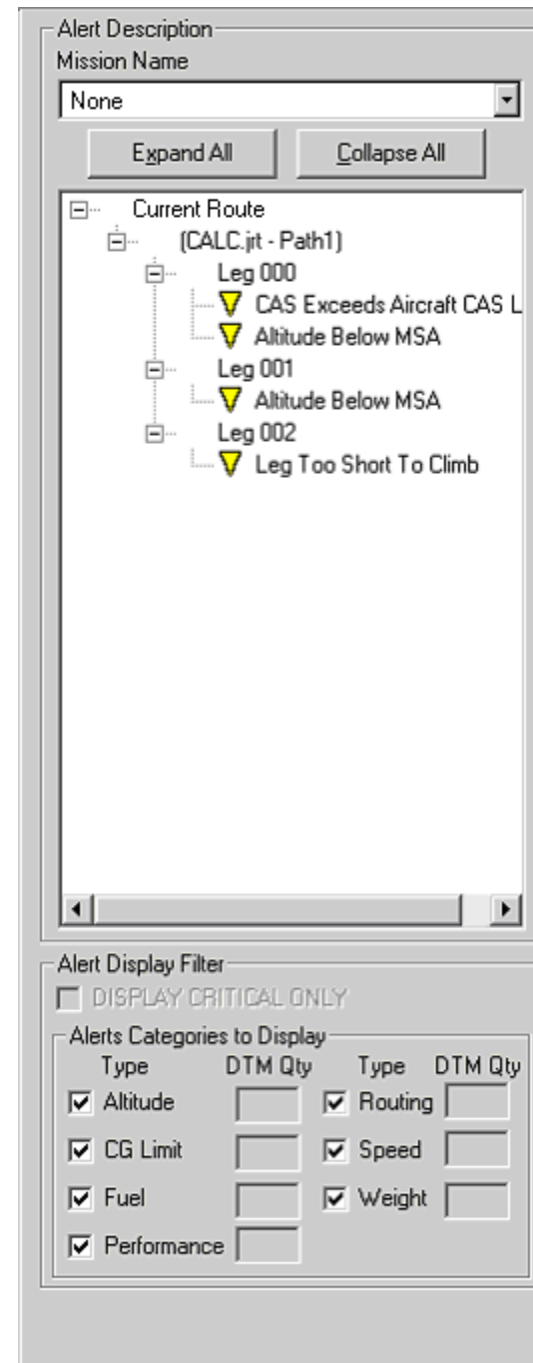
We provide configuration information for each JMPS command via our loadout tab shown on a previous slide. We do CG calculations for the takeoff condition of each leg. We have no weapons (yet) so we have no stores. I just got hold of AWBS, so I will do some evaluation of that product.

One further note: VMPS has put in an administrator controlled capability to define aircraft weight and balancy by BUNO (Marines) or Serial Number (AFSOC). Reading a AWBS XML file to populate the local database would be straight forward. For your effort, I'm not sure if a local JMPS database would be better or just reading the AWBS XML file when the aircraft configuration is selected for a given route.